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| 10/520,816      | 01/07/2005  | Susumu Matsumoto     | 71971-109           | 4853             |

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EXAMINER

MATTHEWS, COLLEEN ANN

|          |              |
|----------|--------------|
| ART UNIT | PAPER NUMBER |
|----------|--------------|

2811

DATE MAILED: 11/29/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/520,816

Applicant(s)

MATSUMOTO ET AL.

Examiner

Colleen A. Matthews

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 14 September 2006.
- 2a) ☒ This action is FINAL. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 4/7/05
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. **Claims 1, 3-6, and 8-15** are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner).
3. **Regarding claim 1**, Steiner discloses an electronic device comprising: a low dielectric constant (Figure 6 42, paragraph 19 lines 20-21) film having a hole (90) and a trench (82) formed in at least an upper portion of the low dielectric constant film to be connected with the hole, a nitrogen-non-containing insulating film (36, paragraph 22) formed under the low dielectric constant film, and a nitrogen-containing insulating film (30, paragraph 20 lines 4-8) formed under the nitrogen-non-containing insulating film, wherein a bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).
4. **Regarding claim 3**, Steiner discloses the device of claim 1, where the lower surface of the low dielectric constant film (42) is in contact with the upper surface of the nitrogen-non-containing insulating film (36).

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5. **Regarding claim 6**, Steiner discloses an electronic device comprising: a low dielectric constant film (42, paragraph 19 lines 20-21) having a hole (90), a nitrogen-non-containing insulating film (48, paragraph 22) formed over the low dielectric constant film, and a nitrogen-containing insulating film (54) formed over the nitrogen-non-containing insulating film, wherein a trench (82), which is connected to the hole, is formed in the nitrogen-containing insulating film (30), the nitrogen-non-containing insulating film (36), and at least an upper portion of the low dielectric constant film (42) and a bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).

6. **Regarding claim 11**, Steiner discloses an electronic device comprising: a low dielectric constant film (42, paragraph 19 lines 20-21) having a hole (90), a first nitrogen-non-containing insulating film (36, paragraph 22) formed under the low dielectric constant film, a second nitrogen-non-containing insulating film (48, paragraph 22) formed over the low dielectric constant film, where a trench (82), which is connected with the hole, is formed in the second nitrogen-non-containing insulating film and at least an upper portion of the low dielectric constant film and the bottom of the trench is located in the middle portion of the low dielectric constant film (the trench, 82, is shown in Figure 6 in the middle portion of two separate portions of the dielectric film 42).

7. **Regarding claims 4-5, 9-10 and 14-15**, Steiner discloses the device of claims 1, 6 and 11, where the low dielectric constant film is a carbon-containing silicon oxide film

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or a porous film (paragraph 19 lines 20-21). Steiner further discloses the carbon-containing silicon oxide film as a SiOC film (paragraph 19 lines 20-21).

8. **Regarding claim 8**, Steiner discloses the device of claim 6, where the upper surface of the low dielectric constant film (42) is in contact with the lower surface of the nitrogen-non-containing insulating film (48).

9. **Regarding claim 12**, Steiner discloses the device of claim 11, where the lower surface of the low dielectric constant film (42) is in contact with the upper surface of the first nitrogen-non-containing insulating film (36).

10. **Regarding claim 13**, Steiner discloses the device of claim 11, where the upper surface of the low dielectric constant film (42) is in contact with the lower surface of the second nitrogen-non-containing insulating film (48).

11. **Claims 16 and 18** are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Pub. No. 2005/0098896 to Huang et al. (Huang).

12. **Regarding claim 16**, Huang discloses an electronic device comprising: a low dielectric constant film (Fig 3 element 306a) having a hole (346a), and a low density insulating film (308a/312a) having a film density of 1.3 g/cm or lower (paragraph 24 lines 16-21) and formed over the low dielectric constant film, where a trench (348a), which is connected with the hole, is formed in the low density insulating film and at least an upper portion of the low dielectric constant film is filled with an interconnect and an upper surface of the interconnect and an upper surface of the low density insulating film

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are on the same level (upper surface of the 312a part of the insulating film and upper surface of 348a interconnect are same level).

13. **Regarding claim 18**, Huang discloses the device of claim 16, further comprising a nitrogen-containing insulating film (Fig 3 element 304a, paragraph 37 lines 1-3 and paragraph 20 lines 4-5) formed under the low dielectric constant film.

***Claim Rejections - 35 USC § 103***

14. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

15. **Claim 2** is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner) in view of applicant's Admitted Prior Art (APA).

16. **Regarding claim 2**, Steiner discloses the device of claim 1, where the hole passes through the nitrogen-non-containing insulating film and the nitrogen-containing insulating film. Steiner lacks disclosing the device further including a lower-level interconnect which is located under the hole and connected with the hole, and the upper surface of the lower-level interconnect, except for a region in which the lower-level interconnect is connected with the hole, is covered with the nitrogen containing insulating film.

The APA discloses a device including a lower-level interconnect (2) which is located under the hole (7) and connected with the hole, and the upper surface of the lower-level interconnect, except for a region in which the lower-level interconnect is connected with the hole, is covered with the insulating film (3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to include a lower-level interconnect under the hole as in the APA in order to provide electrical connection to other circuitry.

17. **Claim 7** is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner) in view of U.S. Pub. No. 2002/0102779 to Yang.

18. **Regarding claim 7**, Steiner discloses the device of claim 6. Steiner lacks disclosing the nitrogen-containing insulating film is an anti-reflection film.

Yang teaches a nitrogen-containing insulating film (Fig 2F element 210, paragraph 21) as an anti-reflection film formed over a dielectric film. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Steiner to have the nitrogen-containing insulating film as an anti-reflection film as in Yang in order to limit reflection during patterning.

19. **Claims 17, 19 and 20** are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Pub. No. 2005/0098896 to Huang et al. (Huang) in view of U.S. Pub. No. 2003/0001273 to Steiner et al. (Steiner).

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20. **Regarding claim 17**, Huang discloses the device of claim 16, as above. Huang lacks teaching the low density insulating film containing Nitrogen. Steiner teaches an insulating film containing Nitrogen. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Huang to have the low density insulating film contain Nitrogen as in Steiner because well known etch chemistries can be used with nitrogen layers.

21. **Regarding claims 19-20**, Huang discloses the device of claim 16, as above, Huang lacks teaching the low dielectric constant film as carbon-containing silicon oxide film, where it is a SiOC film, or a porous film. Steiner teaches a low dielectric constant film as SiOC. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Huang to have the low dielectric constant film as SiOC as in Steiner in order to provide device performance improvements such as reducing propagation delay and therefore improving speed.

### ***Response to Arguments***

Applicant's arguments filed 09/14/2006 have been fully considered but they are not persuasive.

Applicant's argue with regard to claims 1-15 that the "prior art does not disclose a bottom of a trench located in the middle portion of the low dielectric constant film." However, as shown in Figure 6, the low dielectric film, 42, has two parts and the two parts are separated in the middle portion by the trench/bottom of the trench (82).

Applicant's argue with regard to claims 16-20 that the "prior art does not disclose an upper surface of the interconnect and an upper surface of the low density insulating



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film are on the same level." However, examiner's recitation of low density insulating film includes element 312a, which, at an upper surface is at the same level as the upper surface of the interconnect 348a.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen A. Matthews whose telephone number is 571-272-1667. The examiner can normally be reached on Monday - Friday 8AM-4:30PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Richard Elms can be reached on 571-272-1869. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

CAM  
11/20/2006

*Douglas W. Owens* 11/24/06  
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PRIMARY EXAMINER